



July 27, 2004

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
11555 Rockville Pike  
Rockville, Maryland 20852

Serial No.: 04-331  
NL&OS/PRW Rev 3  
Docket Nos.: 50-338/339  
50-280/281  
50-336/423  
License Nos.: NPF-4/7  
DPR-32/37  
DPR-65  
NPF-49

**VIRGINIA ELECTRIC AND POWER COMPANY**  
**DOMINION NUCLEAR CONNECTICUT, INC. (DOMINION)**  
**NORTH ANNA POWER STATION UNITS 1 AND 2**  
**SURRY POWER STATION UNITS 1 AND 2**  
**MILLSTONE POWER STATION UNITS 2 AND 3**  
**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE FABRICATION OF**  
**PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING CONNECTIONS AT**  
**PRESSURIZED WATER REACTORS**

In a letter dated May 28, 2004 the NRC issued NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors [PWRs]." The bulletin: 1) advises PWR licensees that current methods of inspecting Alloy 82/182/600 materials used in fabrication of pressurizer penetrations and steam space piping connections may need to be supplemented with additional measures, 2) requests PWR addressees to provide the NRC with information related to the materials from which pressurizer penetrations and steam space piping connections were fabricated, 3) requests PWR licensees to provide NRC with information related to the inspections that have been and will be performed to ensure degradation of Alloy 82/182/600 materials used in the fabrication of pressurizer penetrations and steam space piping connections will be identified, adequately characterized and repaired, and 4) requires PWR addressees to provide a written response to the NRC in accordance with the provisions of 10 CFR 50.54(f).

Attachment 1 of this letter provides the requested response for Millstone Power Station Unit 3 and North Anna Power Station Units 1 and 2, Attachment 2 provides the requested response for Millstone Power Station Unit 2, and Attachment 3 provides the response for Surry Power Station Units 1 and 2. Commitments included in this correspondence are summarized in Attachment 4.

Should you have any questions regarding Dominion's response to the bulletin, please contact Mr. Paul R. Willoughby at (804) 273-3572.

Very truly yours,

A handwritten signature in cursive script, appearing to read "W R Matthews".

William R. Matthews  
Senior Vice President – Nuclear Operations

Attachments (4)

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SN: 04-331

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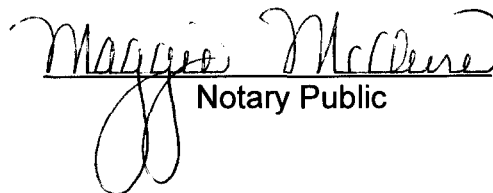
Subject: 60 Day Response to NRC Bulletin 2004-01

COMMONWEALTH OF VIRGINIA     )  
  )  
COUNTY OF HENRICO            )

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by William R. Matthews, who is Senior Vice President - Nuclear Operations of Virginia Electric and Power Company and Dominion Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of those companies, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 27th day of July, 2004.

My Commission Expires: March 31, 2008.

  
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Notary Public

(SEAL)

**ATTACHMENT 1**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE**  
**FABRICATION OF PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING**  
**CONNECTIONS AT PRESSURIZED WATER REACTORS**

**MILLSTONE POWER STATION UNIT 3**  
**NORTH ANNA POWER STATION UNITS 1 AND 2**

**VIRGINIA ELECTRIC AND POWER COMPANY**  
**DOMINION NUCLEAR CONNECTICUT, INC.**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
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**MILLSTONE POWER STATION UNIT 3**  
**NORTH ANNA POWER STATION UNITS 1 AND 2**

In a letter dated May 28, 2004 the NRC issued NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors [PWRs]." The bulletin: 1) advises PWR licensees that current methods of inspecting Alloy 82/182/600 materials used in fabrication of pressurizer penetrations and steam space piping connections may need to be supplemented with additional measures, 2) requests PWR addressees to provide the NRC with information related to the materials from which pressurizer penetrations and steam space piping connections were fabricated, 3) requests PWR licensees to provide the NRC with information related to the inspections that have been and will be performed to ensure degradation of Alloy 82/182/600 materials used in the fabrication of pressurizer penetrations and steam space piping connections will be identified, adequately characterized and repaired, and 4) requires PWR addressees to provide a written response to the NRC in accordance with the provisions of 10 CFR 50.54(f).

The responses for Millstone Power Station Unit 3 and North Anna Power Station Units 1 and 2 are provided below.

**NRC Question:**

- (a) A description of the pressurizer penetrations and steam space piping connections at your plant. At a minimum, this description should include materials of construction (e.g., stainless steel piping and/or weld metal, Alloy 600 piping/sleeves, Alloy 82/182 weld metal or buttering, etc.), joint design (e.g., partial penetration welds, full penetration welds, bolted connections, etc.), and, in the case of welded joints, whether or not the weld was stress-relieved prior to being put into service. Additional information relevant with respect to determining the susceptibility of your plant's pressurizer penetrations and steam space piping connections to PWSCC should be included.

**Dominion Response:**

- (a) See Tables a.1.1, a.1.2.

**NRC Question:**

- (b) A description of the inspection program for Alloy 82/182/600 pressurizer penetrations and steam space piping connections that has been implemented at your plant. The description should include when the inspections were performed; the areas, penetrations and steam space piping connections inspected; the extent (percentage) of coverage achieved for each location which was inspected; the inspection methods used; the process used to resolve any inspection findings; the quality of the documentation of the inspections (e.g., written report, video record, photographs); and, the basis for concluding that your plant satisfies applicable regulatory requirements related to the integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections were found, indicate what follow-up NDE was performed to characterize flaws in the leaking penetrations.

**Dominion Response:**

- (b) The Millstone Unit 3 and North Anna Units 1 and 2 pressurizers consist of stainless steel clad carbon steel vessels with stainless steel penetrations. The safety valve, spray line and relief valve nozzle to safe end welds at Millstone Unit 3 and North Anna Units 1 and 2 have Alloy 82/182 butt welds with Alloy 82/182 weld butter between the carbon steel nozzles and stainless steel safe ends. No other Alloy 82/182/600 pressurizer penetrations or steam space piping connections exist at Millstone Unit 3 or North Anna Units 1 and 2.

Following the events at the Davis-Besse plant, Dominion developed a corporate Boric Acid Corrosion Control (BACC) program [Dominion Nuclear Administrative Procedure 1004 (DNAP-1004)] to prevent boric acid related degradation of the Reactor Coolant System, ASME Class 1, 2 and 3 components and associated/ neighboring structures, systems and components. This program enhanced the already existing Generic Letter 88-05 program by including the Alloy 600/82/182 components/welds in the primary system pressure boundary in the program.

As part of the inspection requirements for the BACC program, Millstone Unit 3 and North Anna Units 1 and 2 require a 100% 360 degree bare metal visual (BMV) inspection (underneath insulation) of all pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 butter welds each refueling outage (RFO). The first such BMV inspection for Millstone Unit 3 was conducted during the spring 2004 RFO, and for North Anna Unit 1 during the spring 2003 RFO. BMV inspections of the pressurizer were performed at North Anna Unit 2 during the fall 2002 RFO and again during the spring 2004 RFO. Ultrasonic testing was also performed on the pressurizer spray line nozzle during the fall 2002 RFO. The results of the Millstone Unit 3 inspection were documented as satisfactory in the Millstone inspection procedure for boric acid corrosion control (AWO M3-03-03588 BACC 003 inspections). The results of the North Anna inspections were documented as

satisfactory in written periodic test reports for each unit and other station documentation. The process in place to resolve inspection findings is discussed in the response to item (c) below; however, this process has not been exercised since there has been no indication of leakage identified during the inspections. Because no leaks have been found, Dominion concludes that applicable regulatory requirements related to the integrity of pressurizer penetrations and steam space piping connections have been satisfied for Millstone Unit 3 and North Anna Units 1 and 2.

**NRC Question:**

- (c) A description of the Alloy 82/182/600 pressurizer penetration and steam space piping connection inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the areas, penetrations and steam space piping connections to be inspected; the extent (percentage) of coverage to be achieved for each location; inspection methods to be used; qualification standards for the inspection methods and personnel; the process used to resolve any inspection indications; the inspection documentation to be generated; and the basis for concluding that your plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections are found, indicate what follow-up NDE will be performed to characterize flaws in the leaking penetrations. Provide your plans for expansion of the scope of NDE to be performed if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.

**Dominion Response:**

- (c) Millstone Unit 3 and North Anna Units 1 & 2 will continue to implement 100% 360 degree bare metal visual (BMV) inspections (underneath insulation) of all pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 butter welds each RFO. Personnel performing these scheduled VT-2 inspections are ASME Section XI VT-2 qualified and have undergone BACC evaluator training per DNAP-1004. All boric acid leaks must be reported if detected visually (no leaking pressure boundary components are permitted to remain in service). Inspection results will be recorded in accordance with site procedures. Leaking welds will be identified by the BACC program, documented in the corrective action system database and resolved by taking the appropriate steps dictated by the corrective action program. If leaking steam space piping connections are found, liquid penetrant tests (PTs) and/or ultrasonic testing (UT) will be performed as appropriate to determine the extent and orientation (axial or circumferential) of the cracking.

Since the Millstone Unit 3 pressurizer nozzle welds have not been volumetrically inspected since 1991, the relief valve, spray line and safety valve nozzle welds will be volumetrically inspected in the fall 2005 RFO. The procedures and examiners for these inspections will comply with ASME Section XI, Appendix VIII, Supplement 10. Because the Supplement 10 procedures have only recently been developed and qualified, it is difficult to predict the extent of coverage that will be achieved on each of these five nozzles prior to the completion of the inspections.

In addition, two of the three 6-inch safety valve nozzle to piping welds at North Anna Unit 2 are scheduled to be inspected as part of the ISI program in the second period of the third interval, which begins on December 14, 2004. The welds will be volumetrically inspected with procedures and examiners that meet ASME Section XI, Appendix VIII, Supplement 10 in the first RFO of the second period, i.e., fall 2005. The weld on the 4-inch relief valve nozzle and the remaining 6-inch safety valve nozzle weld are scheduled to be inspected in the first RFO of the third period, which starts June 14, 2008. Finally, the 4-inch spray line valve to nozzle weld was last volumetrically inspected in 2002. However, these three welds will be re-inspected in the fall 2005 RFO. Because the Supplement 10 procedures have only recently been developed and qualified, it is difficult to predict the extent of coverage that will be achieved when inspecting each of the five nozzles.

The nozzle to piping welds on the North Anna Unit 1 pressurizer were volumetrically inspected in the fall of 2001 and are not due for re-inspection until 2011. However, because of the recent availability of improved inspection procedures and the known susceptibility of Alloy 82 and 182 to environmentally induced cracking at PWR operating conditions, the five nozzle to safe end welds will be proactively re-examined volumetrically in the fall 2004 RFO. As stated above, limitations on coverage are not quantifiable until the inspections have been completed.

Currently, the EPRI Material Reliability Program (MRP) Alloy 600 issue task group is finishing a pipe butt weld safety assessment (MRP-113) that is expected to form the basis for an industry endorsed butt weld inspection method. The safety assessment and proposed inspection method will be considered in Dominion's development of an ongoing inspection program for the subject butt welds that will satisfy applicable regulatory requirements related to structural and leakage integrity of subject pressurizer connections for the long term. Dominion will also be evaluating various options for mitigating primary water stress corrosion cracking (PWSCC) in Alloy 82/182 butt welds. The mitigative strategy selected will also be considered during the development of the butt weld inspection program going forward.

### **Basis for Meeting Regulatory Requirements**

NRC Bulletin 2004-01 notes the following provisions of the NRC regulations and plant operating licenses that pertain to the maintenance of reactor coolant pressure boundary integrity:

- Appendix A to 10 CFR Part 50, “General Design Criteria for Nuclear Power Plants”

Criterion 14 - “Reactor Coolant Pressure Boundary”

Criterion 31 - “Fracture Prevention of Reactor Coolant Pressure Boundary”,  
and

Criterion 32 - “Inspection of Reactor Coolant Pressure Boundary”

- Plant Technical Specifications
- 10 CFR 50.55a, Codes and Standards, which incorporates by reference Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components, of the ASME Boiler and Pressure Vessel Code”
- Appendix B of 10 CFR Part 50, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” Criteria V, IX, and XVI

Dominion’s means of complying with each of these requirements is discussed below.

Design Requirements: 10 CFR § 50, Appendix A – General Design Criteria (GDC)

- Criterion 14 – Reactor Coolant Pressure Boundary  
“The reactor coolant pressure boundary shall be designed, fabricated, erected and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.”
- Criterion 31 – Fracture Prevention of Reactor Coolant Pressure Boundary  
“The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a non-brittle manner, and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient thermal stresses, and (4) size of flaws.”
- Criterion 32 – Inspection of Reactor Coolant Pressure Boundary  
“Components which are part of the reactor coolant pressure boundary shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leak tight integrity, and (2) an appropriate material surveillance program for the reactor pressure vessel.”

During the initial plant licensing of Millstone Power Station Unit 3 and North Anna Power Station Units 1 and 2, it was demonstrated that the design of the reactor coolant pressure boundary met the regulatory requirements in place at that time. The Construction Permit for Millstone Unit 3 was issued after May 21, 1971. As such, the GDC included in Appendix A to 10 CFR Part 50 apply to Millstone Unit 3, and the unit was designed and constructed to those GDC requirements. Unit 3 is subject to the inspections required by the applicable GDC requirements as well. The Construction Permits for North Anna Units 1 and 2 were issued prior to May 21, 1971, however. The GDC included in Appendix A to 10 CFR Part 50 did not become effective until May 21, 1971. Consequently, North Anna Units 1 and 2 were not subject to GDC requirements. (Reference SECY-92-223 dated September 18, 1992.) However, the following information demonstrates compliance with the design criteria relative to the pressurizer penetration nozzles for Millstone Unit 3 and North Anna Units 1 and 2:

Pressurized water reactors licensed both before and after issuance of Appendix A to 10 CFR Part 50 (1971) complied with these criteria in part by: 1) selecting Alloy 600 or other austenitic materials with excellent corrosion resistance and extremely high fracture toughness for reactor coolant pressure boundary materials, and 2) following ASME Codes and Standards and other applicable requirements for fabrication, erection, and testing of pressure boundary components. NRC reviews of operating license submittals subsequent to issuance of Appendix A included evaluating designs for compliance with the General Design Criteria. GDC requirements in effect at the time of North Anna's licensing did not address the selection of Alloy 600. They only required that ASME Code requirements be satisfied.

Although stress corrosion cracking of primary coolant system penetrations was not originally anticipated during plant design, it has occurred in pressurizer penetration nozzles at some other nuclear units. The robustness of the design has been demonstrated by the small amounts of leakage that have occurred in those instances of cracking in pressurizer penetration nozzles. Given the inherently high fracture toughness and flaw tolerance of the Alloy 600 material, the probability of a rapidly propagating failure and rupture is considered to be extremely low. This is consistent with the wording in earlier versions of the applicable GDCs, which presented design criteria in functional terms of extremely low probability of gross rupture or significant leakage throughout design life.

As noted above, a bare-metal visual inspection was performed for the Millstone Unit 3 pressurizer penetrations during the spring 2004 RFO, for North Anna Unit 1 pressurizer penetration nozzles during the spring 2003 RFO, and for North Anna Unit 2 during the fall 2002 and spring 2004 RFOs. Ultrasonic testing was also performed on the North Anna Unit 2 pressurizer spray line nozzle during the fall 2002 RFO. No evidence of boric acid leakage was identified at any pressurizer penetration nozzle inspected during these bare-metal visual inspections.

The criteria established for design, fracture toughness, and inspectability in GDC 14, 31, and 32 respectively have been satisfied as applicable during initial licensing of the three units and continue to be satisfied during operation. Based on inspections to date, there is no plant specific evidence that any of the pressurizer penetration nozzles at Millstone Unit 3 or North Anna Units 1 or 2 is cracked or leaking.

Operating Requirement: 10 CFR 50.36 - Plant Technical Specifications

- 10 CFR 50.36 (2) Limiting Conditions for Operation

“Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met. A technical specification limiting condition for operation of a nuclear reactor must be established for each item meeting one of the following criteria:

Criterion 3: A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 4: A structure, system or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.”

- 10 CFR 50.36 (3) Surveillance Requirements

“Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions will be met.”

The reactor coolant pressure boundary is one of the three physical barriers to the release of radioactivity to the environment. Therefore, Millstone Unit 3 and North Anna Units 1 and 2 Technical Specifications (TS) include a requirement and associated action statements addressing reactor coolant system boundary leakage. The limits for reactor coolant system leakage for each of the three units are one gallon per minute (gpm) for unidentified leakage, ten gpm for identified leakage, and no leakage from the reactor coolant system pressure boundary.

The leakage experienced to date with pressurizer penetration nozzles at other nuclear units was well below the sensitivity of on-line leakage detection systems. A bare-metal visual inspection of the Alloy 82/182/600 pressurizer penetration nozzles was conducted for Millstone Unit 3 during the spring 2004 RFO, for North Anna Unit 1 during the spring 2003 RFO and for North Anna Unit 2 during the fall 2002 and

spring 2004 RFOs. Ultrasonic testing was also performed on the North Anna Unit 2 pressurizer spray line nozzle during the fall 2002 RFO. No indication of leakage was observed. Hypothetically, if a through-wall boundary leak of a pressurizer penetration nozzle increased to the point that the leakage was identified by an on-line leak detection monitor, then that leakage must be evaluated per the specified TS acceptance criteria. Specifically, the plant would be shut down if the leak exceeded TS limits or it was determined to be from the reactor coolant system pressure boundary. Plant TS requirements would continue to be met.

Inspection Requirements: 10 CFR 50.55a and ASME Section XI

10 CFR Part 50.55a requires that inservice inspection and testing be performed per the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, "Inservice Inspection of Nuclear Power Plant Components." Section XI contains applicable rules for examination, evaluation and repair of code class components, including the reactor coolant pressure boundary.

The current ASME Code Edition for each unit is as follows: the 1989 Edition for Millstone Unit 3 and for North Anna Unit 1, and the 1995 Edition, 1996 addenda, for North Anna Unit 2. The current ASME Section XI Code requirement for the inspection of pressurizer penetration nozzles is for a visual (VT-2) examination of the penetrations during the system leakage test of IWB-5221 and/or system pressure test of Code Case N-498-1 (Millstone Unit 3 and North Anna Unit 1 only). Consistent with ASME Code requirements, these examinations are conducted outside the pressurizer insulation. Code relief was granted by the NRC to perform the same VT-2 Code examination when the reactor containment is at atmospheric conditions and the reactor vessel is at ambient pressure and temperature. A volumetric examination of the pressurizer penetrations is required once each inspection interval (i.e., once every 10 years.)

However, as noted in the response to Item (b) above, the inspection requirements for the BACC program for Millstone Unit 3 and North Anna Units 1 and 2 requires a 100% 360 degree bare metal visual (BMV) inspection (underneath insulation) of all pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 butter welds each RFO. A bare-metal visual inspection of the Alloy 82/182/600 pressurizer penetration nozzles was conducted for Millstone Unit 3 during the spring 2004 RFO, for North Anna Unit 1 during the spring 2003 RFO and for North Anna Unit 2 during the fall 2002 and spring 2004 RFOs. Ultrasonic testing was also performed on the North Anna Unit 2 pressurizer spray line nozzle during the fall 2002 RFO. No evidence of boric acid leakage at any Alloy 82/182/600 pressurizer penetration was identified during these inspections.

The acceptance standard for the visual examination is found in paragraphs IWA-5250, "Corrective Measures," and IWB-3522, "Standards for Examination Category B-E, Pressure Retaining Partial Penetration Welds in Vessels," and "Examination Category B-P, "All Pressure Retaining Components." For Class 1

components, Paragraph IWA-5250 requires repair or replacement of the affected part if a through-wall leak is found. IWA-5250 also requires an assessment of any damage associated with boric acid corrosion of steel components. Should repairs to pressurizer penetration nozzles be required, they will be performed in accordance with Section XI requirements, NRC-approved ASME Code Case requirements, or an alternative repair or replacement method approved by the NRC.

Millstone Unit 3 and North Anna Units 1 and 2 comply with the above ASME Code requirements through implementation of their respective inservice inspection programs.

Quality Assurance Requirements: 10 CFR 50, Appendix B

- Criterion V of Appendix B to 10 CFR Part 50

Criterion V of Appendix B to 10 CFR Part 50 states that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Criterion V further states that instructions, procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished. Visual examinations of pressurizer penetration nozzles will be documented in accordance with these requirements.

Any of the work undertaken to inspect, evaluate, and/or repair the Millstone Unit 3 and North Anna Units 1 and 2 pressurizer penetration nozzles is conducted and documented in accordance with existing or new procedures which comply with the respective Quality Assurance (QA) Topical Report, the QA program, and Criterion V of Appendix B to 10 CFR Part 50.

- Criterion IX of Appendix B to 10 CFR Part 50

Criterion IX of Appendix B to 10 CFR Part 50 states that special processes, including nondestructive testing, shall be controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements.

Personnel involved with the evaluation of the inspections are VT-2 qualified in accordance with ASME Code requirements and are familiar with the anticipated type of indication that leakage would cause. Any repair work that may be required in the event that evidence of leakage is identified at any of the Millstone Unit 3 or North Anna Units 1 and 2 pressurizer penetration nozzles will be conducted and documented in accordance with existing or new procedures that will comply with ASME Code, regulatory and Company requirements.

- Criterion XVI of Appendix B to 10 CFR Part 50

Criterion XVI of Appendix B to 10 CFR Part 50 states that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected. For significant conditions adverse to quality, the measures taken shall include cause determination and corrective action to preclude repetition of the adverse conditions.

For potential leakage identified at any pressurizer penetration nozzle, the cause determination is important to understanding the nature of the degradation present and the required actions to mitigate future cracking. Appropriate corrective actions would be initiated to determine the cause of the leakage and the proper repair technique to be used.

Criterion XVI contains two important attributes pertinent to the potential for leakage at any pressurizer penetration nozzle. The first of these is "...that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected." This criterion infers a licensee's responsibility to be aware of industry experience, and has been interpreted in this manner in most plants' corrective action programs. A licensee should determine if industry experience applies to its plant and what, if any, corrective actions are appropriate. This approach is consistent with the NRC's generic communication process for a bulletin, which reports industry experience and requires a response to the NRC. Licensees are expected to evaluate the applicability of the occurrences to their plant and document their findings of the plant specific assessment for NRC review. Both Millstone Unit 3 and North Anna Units 1 and 2 are subject to company procedures that require the appropriate consideration of industry operating experience and the initiation of necessary corrective actions if the industry concerns are determined to be applicable to the plants.

Criterion XVI provides the objectives and goals of the corrective action program, but licensees are responsible for determining a specific process to accomplish these goals and objectives. With regard to the bulletin response, Criterion XVI does not provide specific guidance as to what is an appropriate response, but rather, the licensee is responsible for determining actions necessary to maintain public health and safety. Specifically, in this case, the licensee must justify its actions for addressing the potential of pressurizer penetration nozzle leakage.

The second attribute of Criterion XVI that should be considered is that for "... significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition." The bulletin suggests that for potential pressurizer penetration nozzle leakage, the cause determination is important in understanding the nature of the degradation and the required actions to mitigate future leaks. As part of its

corrective action program, a licensee, through its own efforts or as part of an industry effort, would determine the cause of the leakage in a pressurizer penetration nozzle, if leakage were detected. However, if no known leakage in the pressurizer penetration nozzles was identified through reasonable quality assurance measures or inspection and monitoring programs, this criterion would not require specific action on the part of a licensee for remaining in compliance with the regulation.

However, as noted above, the BACC program implemented for each unit requires BMV inspections of the pressurizer penetrations to be performed each refueling outage. Furthermore, Dominion is planning to perform volumetric examinations of the penetrations during the next refueling outage for each unit. Should any leakage be identified during these inspections, the leakage would be entered into the station corrective action system for evaluation and repair. Specifically, repair or replacement of the affected part would be initiated and an assessment of damage, if any, associated with corrosion of steel components by boric acid would be performed. Should repairs to pressurizer penetration nozzles be required, they will be performed in accordance with Section XI requirements, NRC-approved ASME Code Case requirements, or an alternative repair or replacement method approved by the NRC.

In addition, the EPRI MRP Alloy 600 issue task group is finishing a pipe butt weld safety assessment (MRP-113) that is expected to form the basis for an industry endorsed butt weld inspection method. The safety assessment and proposed inspection method will be considered in Dominion's development of an ongoing inspection program for the subject butt welds that will satisfy applicable regulatory requirements related to structural and leakage integrity of subject pressurizer connections for the long term.

In summary, the Dominion approach to inspection, monitoring, cause determination, and resolution of potential leakage of a pressurizer penetration nozzle is in compliance with the performance-based objectives of Appendix B. Furthermore, as noted above, a bare-metal visual inspection of the Alloy 82/182/600 pressurizer penetration nozzles was conducted for Millstone Unit 3 during the spring 2004 RFO, for North Anna Unit 1 during the spring 2003 RFO and for North Anna Unit 2 during the fall 2002 and spring 2004 RFOs. Ultrasonic testing was also performed on the North Anna Unit 2 pressurizer spray line nozzle during the fall 2002 RFO. No evidence of boric acid leakage at any Alloy 82/182/600 pressurizer penetration was identified during these inspections. Therefore, Dominion continues to believe that the appropriate regulatory requirements have been met to date.

NRC Question:

- (d) In light of the information discussed in this bulletin and your understanding of the relevance of recent industry operating experience to your facility, explain why the inspection program identified in your response to item (1)(c) above is adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.

**Dominion Response:**

- (d) Although a generic issue, the experience at other plants that have had through-wall leakage from Alloy 82/182/600 pressurizer penetrations has been limited and has not represented an immediate safety concern. Safety systems included in plant designs and required to be available during plant operation are able to mitigate the effects of even more significant leaks, up to and including the rupture of the largest piping connection to the pressurizer shell. However, the EPRI MRP Alloy 600 issue task group's preliminary butt weld safety assessment indicates that some smaller diameter Alloy 600 butt welds in Westinghouse pressurizers could transition from circumferential crack initiation to leakage in as little as 1.1 years, from 1 gpm leak rate to failure in as little as 2.6 years, and from crack initiation to critical flaw size (rupture) in as little as 3.7 years. Therefore, 100% BMV inspections each RFO of all pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 butter welds would be effective at finding leakage due to PWSCC flaws before failure would reasonably be expected.

As previously noted above, the EPRI MRP Alloy 600 issue task group is finishing a pipe butt weld safety assessment (MRP-113) that is expected to form the basis for an industry endorsed butt weld inspection method. The safety assessment and proposed inspection method will be considered in Dominion's development of an ongoing inspection program for the subject butt welds that will satisfy applicable regulatory requirements related to structural and leakage integrity of subject pressurizer connections for the long term.

**TABLE a.1.1**  
**BL 2004-01 Question (a) Response**  
**Millstone Power Station Unit 3**

<b>Connection</b>	<b>Quantity</b>	<b>Size (inches)</b>	<b>Material</b>	<b>Joint Design</b>	<b>Stress- Relieved</b>	<b>Additional Information</b>
Pressurizer relief valve nozzle to safe end	1	6	Alloy 82/182	Full Penetration	No	Butter weld
Pressurizer spray valve nozzle to safe end	1	4	Alloy 82/182	Full Penetration	No	Butter weld
Pressurizer safety valve nozzle to safe end	3	6	Alloy 82/182	Full Penetration	No	Butter weld
Pressurizer Heater Sleeve	78	1.13	Stainless Steel	Partial Penetration	No	
Pressurizer Instrumentation Nozzle	8	1.05	Stainless Steel	Partial Penetration	No	
Pressurizer Sample Nozzle	1	1.05	Stainless Steel	Partial Penetration	No	
Pressurizer Manway	1	16	Carbon Steel	N/A	Yes	

**TABLE a.1.2**  
**BL 2004-01 Question (a) Response**  
**North Anna Power Station Units 1 & 2**

<b>Connection</b>	<b>Quantity<sup>[1]</sup></b>	<b>Size (inches)</b>	<b>Material</b>	<b>Joint Design</b>	<b>Stress- Relieved</b>	<b>Additional Information</b>
Pressurizer relief valve nozzle to safe end	1	6	Alloy 82/182	Full Penetration	No	Butter weld. Received heat treatment.
Pressurizer spray valve nozzle to safe end	1	4	Alloy 82/182	Full Penetration	No	Butter weld. Received heat treatment.
Pressurizer safety valve nozzle to safe end	3	6	Alloy 82/182	Full Penetration	No	Butter weld. Received heat treatment.
Pressurizer Heater Sleeve	78	1.13	Stainless Steel	Partial Penetration	No	
Pressurizer Instrumentation Nozzle	8	1.05	Stainless Steel	Partial Penetration	No	
Pressurizer Sample Nozzle	1	1.05	Stainless Steel	Partial Penetration	No	
Pressurizer Manway	1	16	Carbon Steel	N/A	Yes	

<sup>[1]</sup> Quantity is for each pressurizer

**ATTACHMENT 2**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE**  
**FABRICATION OF PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING**  
**CONNECTIONS AT PRESSURIZED WATER REACTORS**

**MILLSTONE POWER STATION UNIT 2**

**DOMINION NUCLEAR CONNECTICUT, INC.**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE**  
**FABRICATION OF PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING**  
**CONNECTIONS AT PRESSURIZED WATER REACTORS**  
**MILLSTONE POWER STATION UNIT 2**

In a letter dated May 28, 2004 the NRC issued NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors [PWRs]." The bulletin: 1) advises PWR licensees that current methods of inspecting Alloy 82/182/600 materials used in fabrication of pressurizer penetrations and steam space piping connections may need to be supplemented with additional measures, 2) requests PWR addressees to provide the NRC with information related to the materials from which pressurizer penetrations and steam space piping connections were fabricated, 3) requests PWR licensees to provide the NRC with information related to the inspections that have been and will be performed to ensure degradation of Alloy 82/182/600 materials used in the fabrication of pressurizer penetrations and steam space piping connections will be identified, adequately characterized and repaired, and 4) requires PWR addressees to provide a written response to the NRC in accordance with the provisions of 10 CFR 50.54(f).

The response for Millstone Power Station Unit 2 is provided below.

**NRC Question:**

- (a) A description of the pressurizer penetrations and steam space piping connections at your plant. At a minimum, this description should include materials of construction (e.g., stainless steel piping and/or weld metal, Alloy 600 piping/sleeves, Alloy 82/182 weld metal or buttering, etc.), joint design (e.g., partial penetration welds, full penetration welds, bolted connections, etc.), and, in the case of welded joints, whether or not the weld was stress-relieved prior to being put into service. Additional information relevant with respect to determining the susceptibility of your plant's pressurizer penetrations and steam space piping connections to PWSCC should be included.

**Dominion Response:**

- (a) See Table a.2.1.

**NRC Question:**

- (b) A description of the inspection program for Alloy 82/182/600 pressurizer penetrations and steam space piping connections that has been implemented at your plant. The description should include when the inspections were performed; the areas, penetrations and steam space piping connections inspected; the extent (percentage) of coverage achieved for each location which was inspected; the inspection methods used; the process used to resolve any inspection findings; the quality of the documentation of the inspections (e.g., written report, video record, photographs); and, the basis for concluding that your plant satisfies applicable regulatory requirements related to the integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections were found, indicate what follow-up NDE was performed to characterize flaws in the leaking penetrations.

**Dominion Response:**

- (b) Millstone Unit 2's pressurizer is a stainless steel clad carbon steel vessel with Alloy 82/182/600 penetrations. The safety valve, spray line and relief valve nozzle to safe end welds at Millstone Unit 2 have Alloy 82/182 butt welds with Alloy 82/182 weld butter between the carbon steel nozzles and stainless steel safe ends. The eight (8) instrument taps and 120 heater penetration nozzles are J-Groove partial penetration Alloy 82/182 connections.

Millstone Unit 2 included the Alloy 600 heater sleeves and instrumentation nozzles on the pressurizers in the inspections for Generic Letter 88-05 starting with the spring 2002 refueling outage (RFO). These inspections were completed with sufficient insulation removed such that a 100% 360-degree view of the bare metal was possible. Dominion subsequently developed a corporate Boric Acid Corrosion Control (BACC) Program (DNAP-1004) to prevent boric acid related degradation of the Reactor Coolant System pressure boundary and other systems that contain boric acid.

A subsequent inspection of the heater sleeves and instrumentation nozzles was performed during the fall 2003 RFO. As a result of these inspections, two heater penetrations in each RFO were documented in the station corrective action program as having leakage. The leakage found during the spring 2002 RFO was repaired with Mechanical Nozzle Seal Assemblies (MNSA) per NRC approved alternative Repair RR-89-35. Following the discovery of the pressurizer heater penetration leakage in the fall 2003 RFO, Millstone Unit 2 performed additional ultrasonic testing (UT) inspections on all four heater sleeves to characterize the type of flaws involved. The technique used was demonstrated to the satisfaction of the Millstone Principal Level III NDE inspector. The inspection volume of the heater sleeve was from 4 inches below the pressurizer to the top of the heater sleeve just inside the pressurizer. These UT inspections found that the cracking was axial in nature, and

the results were documented in a report by the inspection vendor. The leakage detected during the fall 2003 RFO was also repaired with MNSAs per NRC approved Alternative Repair RR-89-43. Once repairs were made and leak tests were satisfactorily performed at system operating temperature and pressure, applicable regulatory requirements related to the integrity of pressurizer penetrations and steam space piping connections were satisfied.

The spray line, relief valve and safety valve nozzles were not formally inspected during the spring 2002 RFO or the fall 2003 RFO. However, other maintenance on the top of the pressurizer necessitated that the insulation be removed, so the area was available for general observation. No indications of general boric acid buildup or debris was noted in available outage records. These nozzles and other Alloy 82/182 welds in the RCS will be added to the BACC inspection procedure prior to the spring 2005 RFO.

**NRC Question:**

- (c) A description of the Alloy 82/182/600 pressurizer penetration and steam space piping connection inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the areas, penetrations and steam space piping connections to be inspected; the extent (percentage) of coverage to be achieved for each location; inspection methods to be used; qualification standards for the inspection methods and personnel; the process used to resolve any inspection indications; the inspection documentation to be generated; and the basis for concluding that your plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections are found, indicate what follow-up NDE will be performed to characterize flaws in the leaking penetrations. Provide your plans for expansion of the scope of NDE to be performed if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.

**Dominion Response:**

- (c) Millstone Unit 2 will continue to implement 100% 360 degree bare metal visual (BMV) inspections (underneath insulation) of the instrument and heater penetration nozzles on the pressurizer and will formally include a BMV of all pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 welds with insulation removed through the spring 2005 RFO. Dominion intends to replace the Millstone Unit 2 pressurizer during the fall 2006 RFO. Personnel performing these scheduled VT-2 inspections are ASME Section XI VT-2 qualified and have undergone evaluator training consistent with the BACC program. All boric acid leaks must be reported if detected visually (no leaking pressure boundary components are permitted to

remain in service). Inspection results will be documented in accordance with the inspection procedure. Leaking nozzles and welds will be identified by the BACC program, documented in the Corrective Action System (CAS) database and resolved by taking appropriate steps dictated by the corrective action program. If leaking steam space piping connections are found, liquid penetrant tests (PTs) and/or ultrasonic testing (UT) will also be performed, as appropriate, to determine the extent and orientation (axial or circumferential) of the cracking.

Should an indication of leakage from a heater sleeve be noted in the next refueling outage before the pressurizer has been replaced, the leaking heater sleeve will be inspected with UT to locate the flaw causing the leakage. This inspection plan is consistent with the Westinghouse Owners Group (WOG) Combustion Engineering (CE) Fleet Pressurizer Heater Sleeve Inspection Plan which was submitted to the NRC on January 30, 2004. If the flaw is determined to be circumferentially oriented, Millstone Unit 2 will develop an appropriate inspection plan and notify the NRC. The UT method for this inspection would be the same as that used during the fall 2003 outage. This method is capable of detecting both axial and circumferential cracks. This technique was demonstrated to the satisfaction of the Millstone Principal Level III NDE inspector. The inspection volume of the heater sleeve would be from 4 inches below the pressurizer to the top of the heater sleeve just inside the pressurizer.

If an indication of leakage from an instrument nozzle is noted during the next refueling outage before the pressurizer has been replaced, Millstone Unit 2 will perform UT of the leaking nozzle to locate the flaw and determine its orientation. As with the heater sleeve plan described above, should the flaws be circumferentially oriented, Millstone Unit 2 will develop an inspection scope and notify the NRC.

#### **Basis for Meeting Regulatory Requirements**

NRC Bulletin 2004-01 notes the following provisions of the NRC regulations and plant operating licenses that pertain to the maintenance of reactor coolant pressure boundary integrity:

- Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants"
  - Criterion 14 - "Reactor Coolant Pressure Boundary"
  - Criterion 31 - "Fracture Prevention of Reactor Coolant Pressure Boundary",  
and
  - Criterion 32 - "Inspection of Reactor Coolant Pressure Boundary"
- Plant Technical Specifications
- 10 CFR 50.55a, Codes and Standards, which incorporates by reference Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components, of the

ASME Boiler and Pressure Vessel Code”

- Appendix B of 10 CFR Part 50, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” Criteria V, IX, and XVI

Dominion’s means of complying with each of these requirements is discussed below.

Design Requirements: 10 CFR § 50, Appendix A – General Design Criteria (GDC)

- Criterion 14 – Reactor Coolant Pressure Boundary  
“The reactor coolant pressure boundary shall be designed, fabricated, erected and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.”
- Criterion 31 – Fracture Prevention of Reactor Coolant Pressure Boundary  
“The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a non-brittle manner, and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient thermal stresses, and (4) size of flaws.”
- Criterion 32 – Inspection of Reactor Coolant Pressure Boundary  
“Components which are part of the reactor coolant pressure boundary shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leak tight integrity, and (2) an appropriate material surveillance program for the reactor pressure vessel.”

During the initial plant licensing of Millstone Power Station Unit 2, it was demonstrated that the design of the reactor coolant pressure boundary met the regulatory requirements in place at that time. The Construction Permit for Millstone Unit 2 was issued prior to May 21, 1971. The GDC included in Appendix A to 10 CFR Part 50 did not become effective until May 21, 1971. Consequently, this unit was not subject to GDC requirements. (Reference SECY-92-223 dated September 18, 1992.) However, the following information demonstrates compliance with the design criteria relative to the pressurizer penetration nozzles:

Pressurized water reactors licensed both before and after issuance of Appendix A to 10 CFR Part 50 (1971) complied with these criteria in part by: 1) selecting Alloy 600 or other austenitic materials with excellent corrosion resistance and extremely high fracture toughness, for reactor coolant pressure boundary materials, and 2) following

ASME Codes and Standards and other applicable requirements for fabrication, erection, and testing of the pressure boundary parts. NRC reviews of operating license submittals subsequent to issuance of Appendix A included evaluating designs for compliance with the General Design Criteria. GDC requirements in effect at the time of Millstone Unit 2's licensing did not address the selection of Alloy 600. They only required that ASME Code requirements be satisfied.

Although stress corrosion cracking of primary coolant system penetrations was not originally anticipated during plant design, it has occurred in pressurizer penetration nozzles at some plants including Millstone Unit 2. However, the robustness of the design has been demonstrated by the small amounts of the leakage that have occurred in those instances of cracking of pressurizer penetration nozzles. Given the inherently high fracture toughness and flaw tolerance of the Alloy 600 material, the probability of a rapidly propagating failure and rupture is considered to be extremely low. This is consistent with the wording in earlier versions of the applicable GDCs, which presented design criteria in functional terms of extremely low probability of gross rupture or significant leakage throughout design life.

As noted above, a bare-metal visual inspection was performed for the Millstone Unit 2 pressurizer heater and instrumentation nozzles during the spring 2002 RFO and the fall 2003 RFO. As a result of both inspections, four heater penetrations have been identified and documented as having leakage (two in each RFO). Because leaks were detected, Millstone Unit 2 performed additional volumetric evaluations to characterize the type of flaw involved as required by the Code. Repairs using MNSAs per NRC approved Alternative Repair RR-89-35 (RO-14) and RR-89-43 (RO-15) were then completed.

As described above, the criteria established for design, fracture toughness, and inspectability in GDC 14, 31, and 32 respectively have been satisfied as applicable during initial licensing of Millstone Unit 2 and continue to be satisfied during operation. Based on relevant inspections to date, four leaking penetrations have been identified and repaired. At this time, there is no specific plant indication that any additional pressurizer penetration nozzles at Millstone Unit 2 are cracked or leaking.

Operating Requirement: 10 CFR 50.36 - Plant Technical Specifications

- 10 CFR 50.36 (2) Limiting Conditions for Operation

"Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met. A technical specification limiting condition for operation of a nuclear reactor must be established for each item meeting one of the following criteria:

Criterion 3: A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 4: A structure, system or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety."

- 10 CFR 50.36 (3) Surveillance Requirements

"Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions will be met."

The reactor coolant pressure boundary is one of the three physical barriers to the release of radioactivity to the environment. Therefore, Millstone Unit 2 Technical Specifications (TS) include a requirement and associated action statements addressing reactor coolant system boundary leakage. The limits for reactor coolant system leakage for Millstone Unit 2 are one gallon per minute (gpm) for unidentified leakage, ten gpm for identified leakage, and no leakage from the reactor coolant system pressure boundary.

The leakage observed from Millstone Unit 2 pressurizer penetration nozzles, as well as those at other nuclear plants, was well below the sensitivity of on-line leakage detection systems. Bare-metal visual inspections of the pressurizer penetration nozzles were conducted during the spring 2002 and fall 2003 Millstone Unit 2 RFOs. As described above, two nozzles were identified as leaking during each of those RFOs. Hypothetically, if a through-wall boundary leak of a pressurizer penetration nozzle increased to the point that the leakage was identified by an on-line leak detection monitor, then that leakage must be evaluated per the specified TS acceptance criteria. Specifically, the plant would be shut down if the leak exceeded TS limits or was determined to be from the reactor coolant system pressure boundary. Plant TS requirements would continue to be met.

#### Inspection Requirements: 10 CFR 50.55a and ASME Section XI

10 CFR Part 50.55a requires that inservice inspection and testing be performed per the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, "Inservice Inspection of Nuclear Power Plant Components." Section XI contains applicable rules for examination, evaluation and repair of code class components, including the reactor coolant pressure boundary.

The current ASME requirements (1989 Edition) for pressurizer penetration nozzles is for a visual (VT-2) examination of the pressurizer during the system leakage test of

IWB-5221 or during the system pressure test of Code Case N-498-1. Consistent with ASME Code requirements, these examinations are conducted outside the pressurizer insulation. However, as noted in the response to Item (b) above, the inspection requirements for the BACC program for Millstone Unit 2 are being revised to require a 100% 360 degree bare metal visual (BMV) inspection (underneath insulation) of the pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 butter welds until the pressurizer is replaced.

A bare-metal visual inspection was performed for the Millstone Unit 2 pressurizer heater and instrumentation nozzles during the spring 2002 and fall 2003 RFOs. As described above Boric acid leakage was detected at two pressurizer heater penetration nozzles during each of these inspections. The leaking penetrations were repaired using MNSAs as described above.

The acceptance standard for the visual examination is found in paragraphs IWA-5250, "Corrective Measures," and IWB-3522, "Standards for Examination Category B-E, Pressure Retaining Partial Penetration Welds in Vessels," and "Examination Category B-P, "All Pressure Retaining Components." For Class 1 components, Paragraph IWA-5250 requires repair or replacement of the affected part if a through-wall leak is found. IWA-5250 also requires an assessment of any damage associated with boric acid corrosion of steel components. Should further repairs to pressurizer penetration nozzles be required, they will be performed in accordance with Section XI requirements, NRC-approved ASME Code Case requirements, or an alternative repair or replacement method approved by the NRC.

Millstone Unit 2 complies with the above ASME Code requirements through implementation of its inservice inspection program.

Quality Assurance Requirements: 10 CFR 50, Appendix B

- Criterion V of Appendix B to 10 CFR Part 50

Criterion V of Appendix B to 10 CFR Part 50 states that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Criterion V further states that instructions, procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished. Visual examinations of pressurizer penetration nozzles are documented in accordance with these requirements.

Any of the work undertaken to inspect, evaluate, and/or repair the Millstone Unit 2 pressurizer penetration nozzles is conducted and documented in accordance with existing or new procedures which comply with the Quality Assurance (QA)

Topical Report, the QA program, and Criterion V of Appendix B to 10 CFR Part 50.

- Criterion IX of Appendix B to 10 CFR Part 50

Criterion IX of Appendix B to 10 CFR Part 50 states that special processes, including nondestructive testing, shall be controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements.

Personnel involved with the evaluation of the inspections are VT-2 qualified in accordance with ASME Code requirements and are familiar with the anticipated type of indication that leakage would cause. Any repair work that may be required in the event that evidence of leakage is identified at any of the Millstone Unit 2 pressurizer penetration nozzles will be conducted and documented in accordance with existing or new procedures that will comply with ASME Code, regulatory and Dominion requirements.

- Criterion XVI of Appendix B to 10 CFR Part 50

Criterion XVI of Appendix B to 10 CFR Part 50 states that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected. For significant conditions adverse to quality, the measures taken shall include cause determination and corrective action to preclude repetition of the adverse conditions.

For potential leakage identified at any pressurizer penetration nozzle, the cause determination is important to understanding the nature of the degradation present and the required actions to mitigate future cracking. Appropriate corrective actions have been and will continue to be initiated to determine the cause of the leakage and the proper repair technique to be used.

Criterion XVI contains two important attributes pertinent to the potential for leakage at any pressurizer penetration nozzle. The first of these is "...that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected." This criterion infers a licensee's responsibility to be aware of industry experience, and has been interpreted in this manner in most plants' corrective action programs. A licensee should determine if industry experience applies to its plant and what, if any, corrective actions are appropriate. This approach is consistent with the NRC's generic communication process for a bulletin, which reports industry experience and requires a response to the NRC. Licensees are expected to evaluate the applicability of the occurrences to their plant and document their findings of the plant specific assessment for NRC review. Millstone Unit 2 is subject to company procedures that require the appropriate consideration of industry operating experience and

the initiation of necessary corrective actions if the industry concerns are determined to be applicable to the plant.

Criterion XVI provides the objectives and goals of the corrective action program, but licensees are responsible for determining a specific process to accomplish these goals and objectives. With regard to the bulletin response, Criterion XVI does not provide specific guidance as to what is an appropriate response, but rather, the licensee is responsible for determining actions necessary to maintain public health and safety. Specifically, in this case, the licensee must justify its actions for addressing the potential of pressurizer penetration nozzle leakage.

The second attribute of Criterion XVI that should be considered is that for "... significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition." The bulletin suggests that for potential pressurizer penetration nozzle leakage, the cause determination is important in understanding the nature of the degradation and the required actions to mitigate future leaks. As part of its corrective action program, a licensee, through its own efforts or as part of an industry effort, would determine the cause of the leakage in a pressurizer penetration nozzle, if leakage were detected. However, if no known leakage in the pressurizer penetration nozzles was identified through reasonable quality assurance measures or inspection and monitoring programs, this criterion would not require specific action on the part of a licensee for remaining in compliance with the regulation.

As noted above, 100%, 360-degree BMV inspections of the pressurizer penetrations will be performed during the 2005 RFO. If any leakage is identified during these inspections, the appropriate corrective actions would be taken in accordance with the station corrective action program. Should repairs to pressurizer penetration nozzles be required, they will be performed in accordance with Section XI requirements, NRC-approved ASME Code Case requirements, or an alternative repair or replacement method approved by the NRC. Furthermore, the pressurizer is scheduled to be replaced during the fall 2006 RFO.

In summary, Dominion's approach to inspection, monitoring, cause determination, and resolution of potential leakage of a pressurizer penetration nozzle is in compliance with the performance-based objectives of Appendix B. In addition, as noted above, a bare-metal visual inspection was performed for the Millstone Unit 2 pressurizer heater penetration nozzles during the spring 2002 and fall 2003 RFOs. Leaking pressurizer heater penetrations identified during those RFOs were repaired and satisfactorily tested in accordance with Code requirements. Therefore, Dominion continues to believe that the appropriate regulatory requirements have been met to date.

**NRC Question:**

- (d) In light of the information discussed in this bulletin and your understanding of the relevance of recent industry operating experience to your facility, explain why the inspection program identified in your response to item (1)(c) above is adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.

**Dominion Response:**

- (d) Although a generic issue and specifically experienced at MPS 2, through-wall leakage of Alloy 82/182/600 pressurizer penetrations has been limited and has not represented an immediate safety concern. Safety systems included in plant designs and required to be available during plant operation are able to mitigate the effects of even more significant leaks, up to and including the gross rupture of the largest piping connection to the pressurizer shell. Therefore, 100% BMV inspections each RFO of all pressurizer safety, spray and relief nozzle Alloy 82/182 butter welds and Alloy 82/182/600 full penetration J groove welds is necessary and would be effective at finding leakage due to primary water stress corrosion cracking flaws before pipe failure would reasonably be expected. Furthermore, this is an interim approach until Dominion replaces the Millstone Unit 2 pressurizer during the fall 2006 RFO.

**TABLE a.2.1**  
**BL 2004-01 Question (a) Response**  
**Millstone Power Station Unit 2**

<b>Connection</b>	<b>Quantity</b>	<b>Size (inches)</b>	<b>Material</b>	<b>Joint Design</b>	<b>Stress- Relieved</b>	<b>Additional Information</b>
Pressurizer relief valve nozzle to safe end	1	4	Alloy 82/182	Full Penetration	No	Butter on nozzle
Pressurizer spray valve nozzle to safe end	1	4	Alloy 82/182	Full Penetration	No	Butter on nozzle
Pressurizer safety valve nozzle to safe end	2	4	Alloy 82/182	Full Penetration	No	Butter on nozzle
Pressurizer heater sleeves to pressurizer	120	1.156	Alloy 82/182	Partial Penetration	No	J Groove weld
Instrument nozzles to pressurizer	8	1	Alloy 82/182	Partial Penetration	No	J Groove weld
Instrument nozzles to safe end	8	1	Alloy 82/182	Partial Penetration	No	Fillet weld
Manway nozzle	1	16	Carbon Steel	N/A	Yes	

**ATTACHMENT 3**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE**  
**FABRICATION OF PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING**  
**CONNECTIONS AT PRESSURIZED WATER REACTORS**

**SURRY POWER STATION UNITS 1 & 2**

**VIRGINIA ELECTRIC AND POWER COMPANY**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE**  
**FABRICATION OF PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING**  
**CONNECTIONS AT PRESSURIZED WATER REACTORS**  
**SURRY POWER STATION UNITS 1 & 2**

In a letter dated May 28, 2004 the NRC issued NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors [PWRs]." The bulletin: 1) advises PWR licensees that current methods of inspecting Alloy 82/182/600 materials used in fabrication of pressurizer penetrations and steam space piping connections may need to be supplemented with additional measures, 2) requests PWR addressees to provide the NRC with information related to the materials from which pressurizer penetrations and steam space piping connections were fabricated, 3) requests PWR licensees to provide NRC with information related to the inspections that have been and will be performed to ensure degradation of Alloy 82/182/600 materials used in the fabrication of pressurizer penetrations and steam space piping connections will be identified, adequately characterized and repaired, and 4) requires PWR addressees to provide a written response to the NRC in accordance with the provisions of 10 CFR 50.54(f).

The response for Surry Power Station Units 1 and 2 is provided below.

**NRC Question:**

- (a) A description of the pressurizer penetrations and steam space piping connections at your plant. At a minimum, this description should include materials of construction (e.g., stainless steel piping and/or weld metal, Alloy 600 piping/sleeves, Alloy 82/182 weld metal or buttering, etc.), joint design (e.g., partial penetration welds, full penetration welds, bolted connections, etc.), and, in the case of welded joints, whether or not the weld was stress-relieved prior to being put into service. Additional information relevant with respect to determining the susceptibility of your plant's pressurizer penetrations and steam space piping connections to PWSCC should be included.

**Dominion Response:**

- (a) See Table a.3.1.

**NRC Question:**

- (b) A description of the inspection program for Alloy 82/182/600 pressurizer penetrations and steam space piping connections that has been implemented at your plant. The description should include when the inspections were performed; the areas, penetrations and steam space piping connections inspected; the extent (percentage) of coverage achieved for each location which was inspected; the inspection methods used; the process used to resolve any inspection findings; the quality of the documentation of the inspections (e.g., written report, video record, photographs); and, the basis for concluding that your plant satisfies applicable regulatory requirements related to the integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections were found, indicate what follow-up NDE was performed to characterize flaws in the leaking penetrations.

**Dominion Response:**

1. Surry Unit 1 and Unit 2 pressurizers consist of stainless steel clad carbon steel vessels with stainless steel penetrations and stainless steel nozzle welds. The pressurizers have no Alloy 82/182/600 components or welds. A 100% bare metal visual (BMV) inspection program for Surry 1 & 2 pressurizers was not required since neither pressurizer has Alloy 82/182/600 components or welds.

Surry's pressurizers are inspected for reactor coolant pressure boundary (RCPB) leakage each refueling outage (RFO) in accordance with the Dominion Boric Acid Corrosion Control (BACC) Program (DNAP-1004). In addition, the pressurizers are inspected in accordance with ASME code requirements for in-service inspection.

**NRC Question:**

- (c) A description of the Alloy 82/182/600 pressurizer penetration and steam space piping connection inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the areas, penetrations and steam space piping connections to be inspected; the extent (percentage) of coverage to be achieved for each location; inspection methods to be used; qualification standards for the inspection methods and personnel; the process used to resolve any inspection indications; the inspection documentation to be generated; and the basis for concluding that your plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections are found, indicate what follow-up NDE will be performed to characterize flaws in the leaking penetrations. Provide your plans for expansion of the scope of NDE to be performed if circumferential

flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.

**Dominion Response:**

- (c) Surry Unit 1 and Unit 2 pressurizers consist of stainless steel clad carbon steel vessels with stainless steel penetrations and stainless steel nozzle welds. The pressurizers have no Alloy 82/182/600 components or welds.

Surry's pressurizers are inspected for RCPB leakage each RFO in accordance with the Dominion BACC Program. In addition, the pressurizers are inspected in accordance with ASME code requirements for in-service inspection.

**NRC Question:**

- (d) In light of the information discussed in this bulletin and your understanding of the relevance of recent industry operating experience to your facility, explain why the inspection program identified in your response to item (1)(c) above is adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.

**Dominion Response:**

- (d) Surry Unit 1 and Unit 2 pressurizers consist of stainless steel clad carbon steel vessels with stainless steel penetrations and stainless steel nozzle welds. The pressurizers have no Alloy 82/182/600 components or welds.

Surry's pressurizers are inspected for RCPB leakage each RFO in accordance with the Dominion BACC Program. In addition, the pressurizers are inspected in accordance with ASME code requirements for in-service inspection.

**TABLE a.3.1**  
**BL 2004-01 Question (a) Response**  
**Surry Power Station Units 1 & 2<sup>1</sup>**

<b>Connection</b>	<b>Quantity<sup>2</sup></b>	<b>Size (inches)</b>	<b>Weld Material</b>	<b>Joint Design</b>	<b>Stress- Relieved</b>	<b>Additional Information</b>
Pressurizer relief valve nozzle	1	6	Stainless Steel	Full Penetration	No	Butt weld
Pressurizer spray valve nozzle	1	4	Stainless Steel	Full Penetration	No	Butt weld
Pressurizer safety valve nozzle	3	6	Stainless Steel	Full Penetration	No	Butt weld
Instrument taps	8	1	Stainless Steel	Full Penetration	No	J Groove
Heater penetrations	78	1	Stainless Steel	Full Penetration	No	J Groove

<sup>1</sup> Surry Units 1 & 2 pressurizers contain no Alloy 82/182/600 materials. All connections are stainless steel.

<sup>2</sup> Quantity is for each pressurizer

**ATTACHMENT 4**

**SIXTY DAY RESPONSE TO NRC BULLETIN 2004-01**  
**INSPECTION OF ALLOY 82/182/600 MATERIALS USED IN THE**  
**FABRICATION OF PRESSURIZER PENETRATIONS AND STEAM SPACE PIPING**  
**CONNECTIONS AT PRESSURIZED WATER REACTORS**

**COMMITMENT SUMMARY**

**VIRGINIA ELECTRIC AND POWER COMPANY**  
**DOMINION NUCLEAR CONNECTICUT, INC.**

### **COMMITMENT SUMMARY**

The following commitments are made in the subject correspondence (Serial No. 04-331)

1. The Millstone Power Station Unit 2 spray line, relief valve, and safety valve nozzle welds will be added to the boric acid corrosion control inspection procedure prior to the spring 2005 refueling outage.
2. The Millstone Unit 3 pressurizer relief valve, spray line and safety valve nozzle welds will be volumetrically inspected in the fall 2005 RFO.
3. The three 6-inch safety valve nozzle to piping welds, the 4-inch relief valve nozzle weld, and the 4-inch spray line valve to nozzle weld for North Anna Unit 1 will be volumetrically inspected with procedures and examiners that meet ASME Section XI, Appendix VIII, Supplement 10 in the fall 2004 RFO.
4. The three 6-inch safety valve nozzle to piping welds, the 4-inch relief valve nozzle weld, and the 4-inch spray line valve to nozzle weld for North Anna Unit 2 will be volumetrically inspected with procedures and examiners that meet ASME Section XI, Appendix VIII, Supplement 10 in the fall 2005 RFO.
5. Millstone Unit 3 and North Anna Units 1 & 2 will continue to implement 100% 360 degree bare metal visual (BMV) inspections (underneath insulation) of all pressurizer safety valve, spray line and relief valve nozzle Alloy 82/182 butter welds each RFO.